

COMMISSIONING AND SPECIAL INSPECTIONS OF SMOKE CONTROL SYSTEMS

1 PURPOSE:

This guideline provides information for the preparation of a Quality Assurance Manual, inspection and testing personnel approval; inspection and testing activities; and the final report requirements for mechanical smoke management systems as addressed in the 2001 California Building Code

2 SCOPE:

A quality assurance plan must outline the typical policies and procedures necessary to verify installation and operational compliance of smoke-control systems. A proposal must be submitted to City of San José Building Division describing the level of detail, qualified personnel and all other aspects described herein,

3 ABBREVIATIONS AND ACRONYMS:

AABC: Associated Air Balance Council

CFM: Cubic Feet per Minute

ISAI : Instrument Society of America

NEBB: National Environmental Balancing Bureau

NICET: National Institute For Certification in Engineering Technologies

QAA: Quality Assurance Agency

TG: Technical Guideline

UBC: Uniform Building Code

4 DEFINITIONS:

Quality Assurance:

An independent evaluation of quality-related performance conducted primarily for the information of those not directly involved in conduct of operations, but who have a need to know.

5 REFERENCES:

2001 California Building Code Chapter 9

Guide to the 1997 UBC Smoke Control Provisions

6 RESPONSIBILITIES:

TESTING AND INSPECTION FOR SMOKE-CONTROL SYSTEMS

All testing and inspection for smoke-control systems shall comply with the codes presently adopted by the City of San José and State of California.

Smoke-control system:

During erection of ductwork (including drywall shafts) and prior to concealment for the purposes of leakage testing and recording of device location.

Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements, and detection and control verification.

6.1 Inspections

6.1.1 Automatic Dampers:

Verify that automatic dampers installed within smoke-control systems ,are listed and conform to the requirements of approved recognized standards. (UBC 905.7.5). See 1994 UBC Chapter 35, Part III. Verify that fire dampers are labeled for use in dynamic systems (UBC 713.12).

6.1.2 Control Air Tubing:

Verify material for tubing and fittings is in conformance with UBC 905.10.2. Verify connection requirements are in compliance with UBC 905.10.2. Verify tubing is in accordance with the approved control diagram.

Verify that all control tubing serving other than smoke-control functions are separated by automatic isolation valves (UBC 905.10.3).

Verify that all tubing has been flushed clean and dry prior to final connections. This function may be done by the contractor and verified by the special inspector (UBC 905.10.1).

6.1.3 Control Diagrams:

Verify location of all fire alarm initiating devices indicated on control diagrams. Verify location of all output devices (dampers, fans, automatic doors, conductors, junction points) are installed according to the approved control diagrams. Verify that fire alarm initiating devices which activate smoke-control are properly zoned in accordance with the respective smoke-control zone. This includes automatic sprinkler systems when applicable (UBC 905.12 and 905.15.8)

6.1.4 Fan Belts:

Verify that belt-driven fans have at least 1.5 times the number of belts required for the design duty with the minimum number of belts being two (UBC 905.7.6).

6.1.5 Marking and Identification:

Verify that the detection and control systems are clearly marked at all junctions, accesses and terminations (UBC 905.11).

6.2 Testing

RECORDING TESTS AND FAILED TESTS OR INSPECTIONS

The QAA shall date specific tests and/or inspections and place them in the final report. The QAA shall advise the City of San José Inspections Division of the proposed inspection and testing scheduling. The QAA shall provide the appropriate documentation to the City of San José Inspections Division in the event that a failing test or inspection has not been corrected by the contractor. Should the contractor not correct the areas failing the test or inspections, a correction notice or notice of violation will be given to the appropriate contractor. Re-testing or inspection shall be rescheduled as soon as possible.

6.2.1 Control Action and Priorities:

Verify that the firefighter's control panel has priority over other building systems [i.e., energy management control systems (EMCS), automatic temperature control (ATC)] in smoke-control mode (UBC 905.13.3).

Verify that the firefighter's smoke control panel functions in accordance with its design intent and the approved Life Safety Package.

Verify that doors, fans and dampers are configured properly and that the appropriate status indication light is lit on the firefighter's control panel.

6.2.2 Control Air Tubing:

Verify that all control air tubing has been pressurized to three times operating pressure for not less than 30 minutes without any noticeable loss in gage pressure prior to final connection to devices (UBC 905.10.4).

6.2.3 Control Air Tubing

Verify that each smoke zone has been put into operation by the actuation of one automatic initiation device. Verify that each additional such device within the zone (this includes sprinkler zones) has been verified to cause the same sequence, but the operation of fan motors may be bypassed after the first few positive trials to prevent damage (UBC 905.15.8).

Verify positive confirmation of actuation, testing and manual override (UBC 905.9.1).

Verify control sequences throughout the system, including verification of override from the firefighter's control panel (UBC 905.15.8).

Simulation of standby power conditions and verification of smoke-control system operations from the firefighter's control panel (UBC 905.15.8).

6.2.4 Dampers;

Verify that dampers have been tested for function in their installed condition (UBC 905.15.4).

Detection Devices:

Smoke or fire detectors that are a part of a smoke-control system will be tested in accordance with the Fire Code by the contractor(s) in their installed condition. Field verification for compliance with all aspects of UBC 905.15 will be performed by the Special Inspection Agency. When testing duct type smoke detectors, both minimum and maximum air flow is required (UBC 905.15.2).

6.2.5 Ducts and Dry Wall Shafts:

During various stages of construction, verify pressure testing to 1.5 times the maximum design pressure in accordance with nationally accepted practices. Perform/verify that measured leakage does not exceed 5 percent of design flow (UBC 905.7.3).

Perform/verify that ducts that are part of a smoke-control system have been traversed using generally accepted practices to determine actual air quantities (UBC 905.15.3).

6.2.6 Fans

Verify that motors driving fans do not operate beyond their name plate horsepower (kilowatts) as determined from measurement of actual current draw or KW meter (UBC 905.7.6).

Examine fans for correct rotation. Verify that measurements of voltage, amperage, revolutions per minute and belt tension have been made (UBC 905.15.6).

Verify proper operation of air flow sensors (UBC 905.9.1).

6.2.7 Inlets and Outlets:

Perform/verify that inlets and outlets have been read using generally accepted practices to determine air quantities and submitted with final report (UBC 905.15.5).

6.2.8 Pressurized Stair Enclosure:

Perform/verify that the upper portion of such enclosures have been provided with controlled relief vent capable of discharging a minimum of 2,500 CFM (1180 Us) of air at the design pressure difference.

Perform/verify that at least 0.05 inch water gage (12.44 Pa) relative to the entrance vestibule is provided (UBC 1009.7).

6.2.9 Response Times:

Perform/verify control and actuation response times.

Control air isolation valves Immediately

Smoke damper closing 15 seconds

Smoke damper opening 15 seconds maximum

Fan starting (energizing) 15 seconds maximum

Fan stopping (de-energizing) Immediately

Fan volume modulation 30 seconds maximum

Pressure control modulation 15 seconds maximum

Temperature control safety override Immediately

Positive indication status 15 seconds maximum

Verify that the firefighter's smoke control panel response time- is the same for automatic and manual smoke-control action initiated from any other building control point (UBC 905.14)

6.2.10 Smoke Barriers:

Perform/verify that measurements using inclined manometers or other approved alternate have been made of the pressure differences across smoke barriers. Such measurements shall be conducted for each possible smoke-control condition. Pressure testing of passive zones shall be done using portable fans; the leakage area used will be in accordance with UBC 905.2.3. Given a pressure difference of 0.05 inch water gage (12.44 Pa) the required CFM can be calculated. Provide this CFM (or less) within the smoke zone and measure the pressure difference across the smoke barrier. Verification of smoke barrier construction will be the building inspector's responsibility (UBC 905.15.7).

The number/percentage of passive zones to be pressure tested will be documented in the life Safety Package by the design professional of record. Calculations for all passive zones will be prepared by the Engineer of Record and supplied to the Air Balance Agency. Testing will be performed by a City of San José Building Division -listed Air Balance Agency.

6.2.11 Standby Power:

Verify that full standby power is automatic within 60 seconds of primary power failure (UBC 905.8.1).

6.2.12 Vestibules:

Verify that the minimum pressure difference within the vestibule with the doors closed is at least 0.05 inch water gage (12.44 Pa) positive pressure relative to the fire floor and 0.05 inch water gage (12.44 Pa) negative relative to the exit enclosure. No pressure difference is required relative to a non-fire floor (UBC 1009.8).

6.3 FINAL REPORTS

Reports shall be in compliance with UBC 905.15.9.

UBC 905.15.9 Reports. A complete report of testing shall be prepared by the special inspector or special inspection agency. The report shall include identification of all devices by manufacturer, nameplate data, design values, measured values and identification tag or mark. The report shall be reviewed by the responsible designer, and when satisfied that the design intent has been achieved, the responsible designer shall affix the designer's signature and date to the report with a statement as follows:

"I have reviewed this report and by personal knowledge and on-site observation, certify that the smoke-control system is in substantial compliance with the design intent, and to the best of my understanding, complies with requirements of the code."

A copy of the final report shall be filed with the City of San José Building Official and an identical copy maintained in the Central Control Station or other approved location at the building.

The above-mentioned report shall have the signature of the approved inspector. The flow and pressure testing professional shall sign and also affix his or her AABC or NEBB agency stamp. The report shall also have the signature and stamp of the Design Professionals of Record. The facility cannot be granted a certificate of occupancy until this information is received.

7 PROCEDURE:

Quality Assurance Agencies that wish to become listed by City of San José may apply for approval using forms available for that purpose. Forms are available from City of San José Inspection Division.

THE SMOKE CONTROL SPECIAL INSPECTION AGENCY MUST BE HIRED DIRECTLY BY THE OWNER. IF THE SYSTEM AIR BALANCE AND SMOKE CONTROL SPECIAL INSPECTION ARE DONE BY ONE COMPANY, THEY MUST BE CONTRACTED DIRECTLY BY THE OWNER.

Each agency seeking approval status must submit a Quality Assurance Manual to City of San José for review and acceptance. The following information shall be included in the Quality Assurance Manual:

7.1 ORGANIZATION OF THE AGENCY:

Description of the organization, including: complete legal name and address.
Names and positions of the principal owners, officers and directors.

7.2 ORGANIZATION HISTORY:

A brief history of the agency and a general description of the types of users of the organizations services shall be provided. This history shall include project specific inspections and testing that are similar to that included in this guideline.

7.3 HUMAN RESOURCES OF THE AGENCY:

Resumes shall be submitted as an addendum to the manual. Identify personnel with the inspection and testing duties they will fulfill in order that a determination of the agency's application for listing can be made.

7.4 MATERIAL RESOURCES OF THE AGENCY:

Enclose an inventory of all measurement and balance instruments. Detail calibration policy and procedures and attach a copy of the most recent calibration records. Provide each instruments manufacturer's specified measurement range along with limits of error.

7.5 INSPECTION AND TESTING FORM:

A copy of the Quality Assurance Agencies Compliance and Noncompliance Form or Forms.

7.6 AUDITS:

Agency Inspectors are subject to performance evaluation of services provided at or away from a project site. Evaluation of approved and listed agencies and personnel may be performed at random both in the field and office, by City of San José staff on a routine or periodic basis or as required by specific operations. All evaluations will be discussed with the QAA. Performance evaluations are required as a condition for approval and listing and to maintain listing status

7.7 PERSONNEL QUALIFICATIONS:

FOR SMOKE-CONTROL LISTING AS A SPECIAL INSPECTOR:

The installing contractors on the project must verify their portion of the work but cannot act as the smoke-control system special inspector

All flow and pressure testing must be done by a City of San José listed AABC or NEBB agency.

7.7.1 California Registered Fire Protection Engineer (FPE):

A California Registered Fire Protection Engineer with smoke management commissioning experience may coordinate and verify all components of the smoke-control system within his or her area of expertise.

7.7.2 California Registered Mechanical Engineer (ME):

A California Registered Mechanical Engineer with building or smoke management commissioning experience may coordinate and verify all components of the smoke-control system within his or her area of expertise.

7.7.3 California Registered Electrical Engineer (EE):

A California Registered Electrical Engineer with control systems experience may coordinate and verify all components of the smoke-control system within his or her area of expertise.

Design Engineers of Record may fulfill the special inspection roll on projects that they have designed.

7.7.4 National Institute for Certification in Engineering Technologies (NICET).

7.7.4.1 Fire Protection Engineering Technology Certification (FPTS):

Automatic Sprinkler System Layout. Minimum Certification: Level II.

May verify automatic sprinkler system is installed in accordance with the smoke zones.

7.7.4.2 Fire Protection Engineering Technology Certification (FPTF):

Fire Alarm Systems. Minimum Certification: Level II.

May verify within their area of expertise, applicable aspects of the fire alarm system, control diagrams and controls.

7.7.4.3 Electrical/Electronics Engineering Technology Certification (EET):

Engineering Technician

May verify control diagram, fan belts, component marking and identification, control action and priorities, fans, response times, and standby power.

7.7.4.4 Mechanical Engineering Technology Certification (MET):

Mechanical Engineering Technology Certification:

Engineering Technician

May verify automatic dampers, control air tubing, control diagram, fan belts, component marking and identification, controls, dampers, fans, and inlets and outlets.

7.7.4.5 ISA, Control System Technician (CST)

Certification: Level 1

May verify automatic dampers, control air tubing, control diagram, fan belts, component marking and identification, control action and priorities, controls, dampers, detection devices, fans, inlet and outlets, response times, and standby power.

Other appropriate certification and experience may be submitted for evaluation. In addition to the qualifications listed above, code knowledge, ability to review construction drawings and construction knowledge are necessary.

8 RECORDS:

Final reports are filed with the City of San José Building Official and kept as a record. An identical copy of the final report shall be maintained at the central control station or other approved location.

9 ATTACHMENTS:

TESTING AND INSPECTION MATRIX

MECHANICAL SMOKE MANAGEMENT SYSTEMS

MECHANICAL SMOKE MANAGEMENT TESTING AND INSPECTION MATRIX

		FPE	MPE	EE	FPTS	FPTF	EET	MET	CST	AABC	NEBB
INSPECT	Automatic Dampers	V	V	V				V	V	V	V
	Control Air Tubing	V	V					V	V	V	V
	Control Diagram	V	V	V	P	P	V	V	V		
	Fan Belts	V	V	V			V	V	V	V	V
	Marking & Identification	V	V	V			V	V	V		
TEST	Control Action & Priorities		V	V			V		V		
	Control Air Tubing	V	V					V	V	V	V
	Controls	V	V	V	P	P			V		
	Dampers	V	V	V				V	V	V	V
	Detection Devices	V	V		P	P			V		
	Ducts & Drywall Shafts		V							V	V
	Fans	V	V	V			V	V	V	V	V
	Inlet & Outlets		V					V		V	V
	Pressurized Stair Enclosure		V							V	V
	Response Times	V		V			V		V		
	Smoke Barriers							V		V	V
	Standby Power	V		V			V		V		
	Vestibules									V	V

V: May verify this part of the system.

P: May verify a portion of this part of the system.

* All flow and pressure testing must be done by a City of San José (CSJ) listed AABC or NEBB agency and verified by the appropriate CSJ-approved Mechanical Smoke Management Systems Special Inspector.

** Mechanical Smoke Management Special Inspection Agency must be hired by the owner

SPECIAL INSPECTOR REGISTRATION AND CERTIFICATION REQUIREMENTS

FPE: California Registered Fire Protection Engineer

ME: California Registered Mechanical Engineer

EE: California Registered Electrical Engineer

FPTS: Nicet Fire Protection Engineering Technology, Sprinklers

FPTF: Nicet Fire Protection Engineering Technology, Fire Alarm

EET: Nicet Electrical/Electronics Engineering Technology

MET: Nicet Mechanical Engineering Technology

CST: ISA Control Systems Technician

AABC: Associated Air Balance Council

NEBB: National Environmental Balancing Bureau